

REMARKS

Claims 13-24 and 26 are pending. Claim 13 has been amended.

Claims 13, 15, 17, and 21 were rejected under 35 U.S.C. §103(a) as being unpatentable over *Shimawaki* (USP 5,903,018) in view of Frank et Al. (USP 4,831,082). Favorable reconsideration of this rejection is earnestly solicited.

The claimed invention has a feature that the substrate is formed of InP, the base layer is formed of carbon-doped $\text{Ga}_x\text{In}_{1-x}\text{As}_y\text{Sb}_{1-y}$, and the emitter layer is formed of InP. That is, the claimed invention relates to InP/GaInAsSb-based heterojunction bipolar transistor (HBT) formed on the InP substrate. In the InP/GaInAsSb-based HBT, the InP substrate must be used as the substrate in order to lattice-match the HBT layers (including the base layer, the emitter layer, and the collector layer) with the substrate. According to this, the good crystallinity of the HBT layers can be obtained and the excellent performance of the HBT can be achieved.

On the other hand, *Shimawaki* discloses AlGaAs/GaAs-based HBT formed on the GaAs substrate. In the AlGaAs/GaAs-based HBT, the GaAs substrate must be used as the substrate in order to lattice-match the HBT layers with the substrate for the same reason as described above. Thus, one of ordinary skill in the art would not have formed the AlGaAs/GaAs-based HBT layer of *Shimawaki* on the InP substrate.

As described above, *Shimawaki* relates to the AlGaAs/GaAs-based HBT formed on the GaAs substrate, so that the HBT of *Shimawaki* basically differs from the InP/GaInAsSb-based HBT formed on the InP substrate of the present invention. The selection of the materials of the HBT layers depends on the lattice constant of the substrate, because the HBT layers must be

epitaxially grown on the substrate. If the substrates differ with each other, the selection of materials also differs with each other. The materials applied to the HBT formed on the InP substrate cannot be simply applied to the HBT formed on the GaAs substrate. Thus, one of ordinary skill in the art would not apply the InP emitter layer to the HBT formed on the GaAs substrate.

The Examiner states that the InP emitter layer of *Frank et al.* may be substituted for the AlGaAs emitter layer of *Shimawaki* in order to improve transistor characteristics by increasing the electron mobility when compared with an AlGaAs emitter layer as taught by *Frank et al.* However, as described above, one of ordinary skill in the art would not apply the InP emitter layer to the HBT formed on the GaAs substrate.

As described above, *Shimawaki* and *Frank et al.* are clearly different from the present invention and do not provide any motivation for the present invention. Thus, the present invention would not have been obvious to one of ordinary skill in the art, even if *Shimawaki* and *Frank et al.* are combined.

Claim 20 was rejected under 35 U.S.C. 103(a) as being unpatentable over *Shimciwald* and *Frank et al.* in view of *Hashimoto et al.* (USP 5,846,869). This rejection is respectfully traversed.

As described above, *Shimawaki* and *Frank et al.* clearly differ from the present invention and do not provide any motivation for the present invention.

Hashimoto et al. teaches that the thermal treatment for eliminating hydrogen. However, the thermal treatment of *Hashimoto et al.* is conducted in order to eliminate hydrogen termination and/or OH group terminations adhered to the surface of the base layer. The thermal treatment of *Hashimoto et al.* is to modify the surface state of the base layer. On the other hand,

in the present invention, the thermal treatment is conducted in order to eliminate hydrogen in the base layer introduced into the base layer during the deposition of the base layer by MOCVD. The thermal treatment of the present invention is to improve the film quality of the base layer. Thus, the thermal treatment of *Hashimoto et al.* is clearly different from the present invention.

As described above, *Shimawaki, Frank et al.* and *Hashimoto et al.* are clearly different from the present invention and do not provide any motivation for the present invention. Thus, the present invention would not have been obvious to one of ordinary skill in the art, even if *Hashimoto et al.* is further considered.

For at least the foregoing reasons, the claimed invention distinguishes over the cited art and defines patentable subject matter. Favorable reconsideration is earnestly solicited.

Should the Examiner deem that any further action by applicants would be desirable to place the application in condition for allowance, the Examiner is encouraged to telephone applicants' undersigned attorney.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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